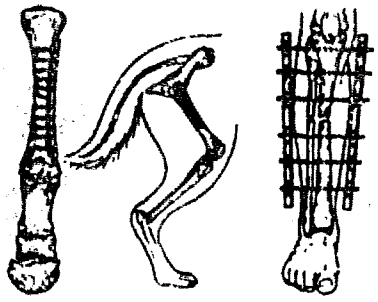

Comparative Orthopaedic
Research Laboratory

(1)

June 13, 1994

Defense Technical Information Center
Building 5, Cameron Station
Alexandria, VA 22304-6145

RE: Grant no. N00014-93-1-0745; The effect of cementation and autogenous bone grafting on allograft union and incorporation.

To whom it may concern:

Enclosed please find the interim progress report for the above referenced grant. The project is progressing on schedule, with no significant delays. Thank you for your continued support on this effort.

Sincerely,

Mark D. Markel

Mark D. Markel, DVM, PhD
Director, Comparative Orthopaedic
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Interim Performance Report

Name and Address of the University: Board of Regents of the University of Wisconsin System

Title of Project: The Effect of Cementation and Autogenous Bone Grafting on Allograft Union and Incorporation

Grant Number: N00014-93-1-0745

Principle Investigator: Mark D. Markel, DVM, PhD

Covered Time Period: February 1 through May 30, 1994

Progress:

This study is designed to examine the reconstruction of bone after segmental bone loss. Project milestones may be divided as follows:

I. Phase I: *In vitro* evaluation of allograft/host bone constructs.

Status: Active.

Accomplishments: During this time period the *in vitro* testing has been completed. Cadaver bones were prepared with a 6-cm segmental bone graft (autograft to simulate the "best fit" possible with an allograft) and then stabilized with an interlocking nail placed down the medullary canal, including 2 screws placed above the graft and 2 screws below the graft. To this construct, the presence or absence of bone cement around the nail through the graft segment was tested biomechanically. This test simulates the time zero point, before any bone healing has occurred. The data has yet to be statistically analyzed. However, it appears that the 2 constructs performed similarly for the various mechanical tests conducted (compression, bending, and torsion). While it is nice to see differences between treatments, these results are not unexpected for these tests. At time zero the graft segment is an isolated entity, since there is no union between host bone and graft bone. At this time, the primary structures resisting the forces applied during the mechanical tests are the nail and screws. The treatment of adding cement arouud the nail is designed to have its greatest benefit after the bone junctions heal and the graft segment is being remodeled. At this later time point, the graft segment is weaker. It is thought that the addition of cement around the nail, within the graft, will increase the bone's strength and decrease the incidence of fracture. The *in vivo* tests will verify whether this is true.

II. Phase II: *In vivo* study - effects of cementation and cancellous graft.

A. Immunologic mismatching and base line values for dogs (radiographs, bone mineral density, and force plate analysis).

Status: Active.

Accomplishments: The dogs for Phase II arrived at the end of May, as planned. To ensure that the bone responses observed after surgery are due to the treatments and not an immunologic response, it is important that all dogs have the same degree of immunologic reaction. It would be very difficult to immunologically match the number of animals in this study (or most other studies). Therefore, it is accepted to immunologically mismatch all of the graft donor-recipient pairs. This has been somewhat challenging due to the genetic similarity of our animals. The first mixed lymphocyte culture assays have been performed, and more will continue to be performed as this phase progresses. As the surgeries continue, each dog is first radiographed, its bone mineral density determined, and a base line force plate gait analysis completed. These results will be compared to post-surgery evaluations later in the study.

B. Surgical procedures - segmental allografts plus treatments.

Status: Active.

Accomplishments: The surgical procedures to evaluate allograft stabilization techniques and the effect of adding cancellous bone graft around the bone junctions have begun. While only 3 procedures have been completed to date, this phase is on schedule, with the 32 surgeries expected to be completed by September. Due to our dogs being smaller than we had anticipated, we had to custom design an interlocking nail rather than use a commercially available design. All dogs will receive similar nails, and an additional subset of cadaver bones will ultimately be tested with the smaller nails to validate the results from Phase I.

C. Dog follow up - radiographs, bone mineral density, and force plate analysis.

Status: Pending. Post-surgical follow up evaluations begin the week of June 20, 1994, and will continue through March, 1995.

D. Biomechanical testing and histologic analysis at 6 months post-surgery.

Status: Inactive. Will begin December, 1994, and finish March, 1995 (mechanical testing), and approximately July, 1995 (histology).

III. Publication and presentation of results.

Status: Inactive. It is planned that initial results will be put together as an abstract for submission to the Fifth International Conference on the Chemistry and Biology of Mineralized Tissues (submission due February, 1995; conference held October, 1995).